

Highly Confidential - Attorneys' Eyes Only

UNITED STATES DISTRICT COURT  
NORTHERN DISTRICT OF CALIFORNIA  
SAN FRANCISCO DIVISION

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ORACLE AMERICA, INC.,                    )  
Plaintiff,                                    )  
vs.    ) No. CV 10-03561 WHA  
GOOGLE, INC.,                            ) VOLUME I  
Defendant.                                 )

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Videotaped Deposition of ROBERT VANDETTE,  
taken at 42 Chauncy Street, Boston,  
Massachusetts, commencing at 10:02 a.m.,  
Wednesday, September 7, 2011, before  
Jill Shepherd, RPR, MA-CSR No. 148608,  
NH-CSR No. 128, CA-CSR No. 13275, CLR,  
and Notary Public.

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| <p>1 preserve the objection. I don't believe<br/>2 this was produced to Oracle, but perhaps you<br/>3 can confirm that after this deposition and<br/>4 we can take it off line.<br/>5 Q. Are you familiar -- have you seen this<br/>6 presentation before?<br/>7 A. (Witness reviewing document).<br/>8 MS. AGRAWAL: Objection. Form.<br/>9 MR. FRANCIS: I would note that<br/>10 this presentation is cited in Oracle's claim<br/>11 charts.<br/>12 MS. AGRAWAL: The video?<br/>13 MR. FRANCIS: So you should be<br/>14 familiar with it.<br/>15 MS. AGRAWAL: The video or the<br/>16 actual presentations?<br/>17 MR. FRANCIS: Both, I believe.<br/>18 MS. AGRAWAL: All right. Let's<br/>19 take it off line.<br/>20 A. (Witness reviewing document).<br/>21 I may have seen a presentation similar<br/>22 to this. I can't confirm that this is the<br/>23 exact content that I have seen or whether I<br/>24 read through the entire presentation.<br/>25 Q. Okay. Just for a second, jump to slide 11,</p> <p style="text-align: right;">Page 42</p>         | <p>1 Q. All I asked if you see this third line, and<br/>2 if you understand what it seems to be<br/>3 saying. I'm not asking if you agree with<br/>4 it.<br/>5 A. I do not agree with --<br/>6 MS. AGRAWAL: You've got to let me<br/>7 object. The court reporter has to be able<br/>8 to take it down. Sorry.<br/>9 Objection. Form.<br/>10 A. I do see it and I do not agree with it.<br/>11 Q. Have you run any tests to determine what<br/>12 percentage of the time the CPU spends<br/>13 executing byte codes as opposed to natively<br/>14 compiled code?<br/>15 MS. AGRAWAL: Objection. Form.<br/>16 A. I have performance analysis in the past on<br/>17 our own virtual machines, and it very much<br/>18 depends on the byte codes and the program<br/>19 that you are running whether it spends<br/>20 little or a lot of time in the JIT -- or in<br/>21 executing byte codes, I'm sorry.<br/>22 Q. Maybe we can clarify just a little bit.<br/>23 Your performance report is measuring<br/>24 the performance of the Dalvik Virtual<br/>25 Machine, but not Android operating system</p> <p style="text-align: right;">Page 44</p> |
| <p>1 there's a diagram that's labeled "Dalvik<br/>2 Trace JIT Flow"?<br/>3 A. Okay.<br/>4 Q. Have you seen this before?<br/>5 A. No, I have not.<br/>6 Q. Now looking at slide five, the third point<br/>7 that's listed here, it says, "Typically,<br/>8 less than a third of time spent in the<br/>9 interpreter."<br/>10 Do you see that?<br/>11 A. This is very subjective.<br/>12 Doing what?<br/>13 Q. Do you understand generally what it means?<br/>14 I'm not asking if you agree, but do you<br/>15 understand what it's saying here?<br/>16 A. I would just like to come to your point --<br/>17 MS. AGRAWAL: Objection. Form.<br/>18 A. -- with the data on this slide that shows<br/>19 that running the checkers, that you're<br/>20 running 93 percent of the time in JIT code<br/>21 cache. So you are using almost 100 percent<br/>22 of the CPU when you are running checkers, so<br/>23 how do you conclude, then, that one-third of<br/>24 the time you are, on average, in<br/>25 interpreter?</p> <p style="text-align: right;">Page 43</p> | <p>1 overall --<br/>2 MS. AGRAWAL: Objection. Form.<br/>3 Q. -- is that correct?<br/>4 MS. AGRAWAL: Objection. Form.<br/>5 A. It's difficult to answer that question<br/>6 because the Dalvik Virtual Machine is part<br/>7 of the Android operating system, so which<br/>8 part are you --<br/>9 Q. Is it part of the prior Android operating<br/>10 system?<br/>11 MS. AGRAWAL: Objection. Form.<br/>12 A. My report states that I disabled much of the<br/>13 Android platform so the CPU was available<br/>14 for executing these benchmarks, so...<br/>15 Q. In a normal environment, is much of the<br/>16 Android platform disabled?<br/>17 MS. AGRAWAL: Objection. Form.<br/>18 A. In the normal Android platform, there is<br/>19 many Dalvik Virtual Machines running, which<br/>20 could have interfered with my results.<br/>21 Q. In a normal environment, is there anything<br/>22 other than a Dalvik Virtual Machine running<br/>23 on the Android operating system?<br/>24 MS. AGRAWAL: Objection. Form.<br/>25 A. It's running on top of the Linux kernel, but</p> <p style="text-align: right;">Page 45</p>                   |

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| <p>1 Q. I'm not asking you for a specific number.<br/>2 Give me a general ballpark figure.<br/>3 MS. AGRAWAL: Objection. Form.<br/>4 A. You are asking me to describe changes or<br/>5 incremental performance improvements in<br/>6 groups that I really wasn't involved in.<br/>7 Q. Turning to page eight, paragraph 28 of your<br/>8 report, you discuss the modifications that<br/>9 you made to conduct your experiments; is<br/>10 that correct?<br/>11 A. Yes.<br/>12 Q. And you created these modifications based on<br/>13 what you were told by Professor Mitchell and<br/>14 Peter Kessler; is that correct?<br/>15 MS. AGRAWAL: Objection. Form.<br/>16 A. Yes. We discussed the functionality, and<br/>17 Peter I both looked through the sources to<br/>18 try to find out how to properly disable this<br/>19 functionality, and we came to a consensus.<br/>20 Q. It appears that you attempted two out of<br/>21 three possible scenarios here?<br/>22 A. That's correct.<br/>23 MS. AGRAWAL: Sorry, objection.<br/>24 Form.<br/>25 Q. The first scenario in paragraph 28 is</p> <p style="text-align: right;">Page 82</p>   | <p>1 A. It would impact the results potentially,<br/>2 since I'd be adding additional functionality<br/>3 to Dalvick that it doesn't currently have.<br/>4 Q. It would, however, be technically possible<br/>5 for someone to do so?<br/>6 MS. AGRAWAL: Objection. Form.<br/>7 A. Let's see. It may be technically possible<br/>8 to build a system that does quickening<br/>9 without side tables, but it would involve<br/>10 adding additional overhead that Dalvick<br/>11 doesn't currently have.<br/>12 Q. In paragraph 36, you state that you did not<br/>13 try running the trace compiler; is that<br/>14 correct?<br/>15 A. Oh, paragraph -- sorry. That is correct,<br/>16 for the same reason that we didn't do the<br/>17 quickening alone.<br/>18 Q. What is the trace compiler?<br/>19 MS. AGRAWAL: Objection. Form.<br/>20 A. That is Dalvick's implementation of a JIT.<br/>21 Q. Are you saying that for your performance<br/>22 benchmark regarding the '104 patent you had<br/>23 to disable the JIT?<br/>24 MS. AGRAWAL: Form.<br/>25 A. That's correct.</p> <p style="text-align: right;">Page 84</p>  |
| <p>1 building side tables, but not quickening<br/>2 instructions, and the second scenario is not<br/>3 building side tables or quickening<br/>4 instructions; is that correct?<br/>5 A. That's correct.<br/>6 Q. Is there a third possibility of not building<br/>7 side tables, but building quickening<br/>8 instructions?<br/>9 MS. AGRAWAL: Objection. Form.<br/>10 A. The quickening was dependent upon the side<br/>11 table for its implementation in order to<br/>12 avoid, you know, any possible error in the<br/>13 results. We did not want to substantially<br/>14 modify Dalvick in order to try to attempt<br/>15 that. We wanted to restrict our changes to<br/>16 just simple commenting out of code that<br/>17 would provide the before and after.<br/>18 Q. So if it got too complicated, you did not<br/>19 attempt it?<br/>20 MS. AGRAWAL: Objection. Form.<br/>21 A. It's not an issue of complication. It's an<br/>22 issue of possibly altering the Dalvick to<br/>23 the point where I wouldn't be measuring what<br/>24 I wanted to measure.<br/>25 Q. It would be --</p> <p style="text-align: right;">Page 83</p> | <p>1 Q. Do you understand that the JIT is not part<br/>2 of the accused functionality of the '104<br/>3 patent?<br/>4 MS. AGRAWAL: Objection. Form.<br/>5 A. I'm not certain that it isn't somehow<br/>6 involved in some of the claims, but we<br/>7 focused on turning off the functionality in<br/>8 a mode that was possible.<br/>9 Q. If, in fact, JIT is not part of the accused<br/>10 functionality, then wouldn't disabling it<br/>11 affect the performance of this benchmark?<br/>12 MS. AGRAWAL: Objection. Form.<br/>13 A. I do believe that the numbers would be<br/>14 slightly different; however, the overhead of<br/>15 having to re-resolve all of the classes,<br/>16 fields, and methods is a fixed overhead that<br/>17 the JIT could not compensate for. So I<br/>18 believe the performance reduction or<br/>19 degradation would still be substantial.<br/>20 Q. Despite fixed overhead, you are referring to<br/>21 other aspects of the benchmarking programs<br/>22 might execute faster if the JIT was enabled;<br/>23 is that correct?<br/>24 MS. AGRAWAL: Objection. Form.<br/>25 A. They would be severely diminished by the</p> <p style="text-align: right;">Page 85</p> |

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| <p>1 JIT compiler?</p> <p>2 MS. AGRAWAL: Objection. Form,</p> <p>3 beyond the scope.</p> <p>4 A. I understand that HotSpot method-based JIT</p> <p>5 compiler and Android is a trace-based JIT</p> <p>6 compiler.</p> <p>7 Q. If Android was using a method-based JIT</p> <p>8 compiler, is it your belief that it would</p> <p>9 infringe the patent?</p> <p>10 MS. AGRAWAL: Objection. Form,</p> <p>11 beyond the scope.</p> <p>12 A. You'd have to show me and my team the</p> <p>13 implementation in order to determine that.</p> <p>14 Q. Does HotSpot practice -- strike that.</p> <p>15 Does the HotSpot Just-In-Time compiler</p> <p>16 practice the '205 patent?</p> <p>17 MS. AGRAWAL: Objection. Form,</p> <p>18 beyond the scope.</p> <p>19 A. It's my understanding that this patent was</p> <p>20 issued around the time of early Java, but we</p> <p>21 had alternative -- we had a -- you know, a</p> <p>22 pre-computer HotSpot compiler, so it's hard</p> <p>23 to say. My guess, I would believe it would.</p> <p>24 Q. The current HotSpot Just-In-Time compiler</p> <p>25 practices the '205 patent?</p> <p style="text-align: right;">Page 98</p>                             | <p>1 -Xint:fast mode and the -Xint:jit mode for</p> <p>2 the interpreter versus the JIT-enabled</p> <p>3 results.</p> <p>4 Q. Paragraph 49, you say, "These tests show the</p> <p>5 performance difference that JIT provides</p> <p>6 above and beyond interpreter only"; is that</p> <p>7 correct?</p> <p>8 A. Yes.</p> <p>9 Q. Is the accused functionality the entire JIT</p> <p>10 or only a specific portion within the JIT?</p> <p>11 MS. AGRAWAL: Objection. Form.</p> <p>12 A. As I understand it, it's the technique used</p> <p>13 to store the results of the JIT and such.</p> <p>14 If you are unable to store the results of</p> <p>15 the trace JIT, you wouldn't have a JIT;</p> <p>16 therefore, disabling the JIT is comparable</p> <p>17 to disabling the patent.</p> <p>18 Q. Are there other ways to store the results of</p> <p>19 the JIT?</p> <p>20 MS. AGRAWAL: Objection. Form,</p> <p>21 beyond the scope.</p> <p>22 A. I don't know. You are asking: Are there</p> <p>23 other ways to store the results that are not</p> <p>24 infringing? Is that what you are asking me?</p> <p>25 Q. I'm asking you: Is the only way to</p> <p style="text-align: right;">Page 100</p> |
| <p>1 MS. AGRAWAL: Objection. Form,</p> <p>2 beyond the scope, and calls for a legal</p> <p>3 conclusion.</p> <p>4 A. From my understanding, I believe it does.</p> <p>5 Q. Did you try comparing the performance of a</p> <p>6 current HotSpot Just-In-Time compiler with</p> <p>7 one that existed before the '205 patent?</p> <p>8 MS. AGRAWAL: Objection. Form,</p> <p>9 beyond the scope.</p> <p>10 A. From my report, I measured the current</p> <p>11 HotSpot implementation.</p> <p>12 Q. Looking at page 18 of your report, the chart</p> <p>13 here is entitled "Android CaffeineMark JIT</p> <p>14 Improvement Results."</p> <p>15 Does this reflect the difference</p> <p>16 between running Android with and without a</p> <p>17 JIT?</p> <p>18 MS. AGRAWAL: Objection. Form.</p> <p>19 I also just note for the record that</p> <p>20 we produced this to Google in color, and so</p> <p>21 this isn't the original that was -- the</p> <p>22 report wasn't what was given to Google; but</p> <p>23 you can answer the question.</p> <p>24 A. The command that I used to execute is in the</p> <p>25 report. It's on paragraph 49. I used</p> <p style="text-align: right;">Page 99</p> | <p>1 implement a JIT is by using the '205 patent?</p> <p>2 MS. AGRAWAL: Objection. Form,</p> <p>3 beyond the scope.</p> <p>4 A. I don't know.</p> <p>5 Q. If there was a way to implement a JIT</p> <p>6 without practicing the '205 patent, would it</p> <p>7 make sense to benchmark the performance</p> <p>8 between that JIT and the current Android JIT</p> <p>9 that Oracle alleges infringes the '205</p> <p>10 patent?</p> <p>11 MS. AGRAWAL: Objection. Form,</p> <p>12 beyond the scope.</p> <p>13 A. You are asking me to speculate on something</p> <p>14 which I have already stated that I don't</p> <p>15 know how you would do. So, again, the</p> <p>16 answer is, I don't know.</p> <p>17 Q. In paragraph 53, you say, "Before starting</p> <p>18 each benchmark run, the script cleans out</p> <p>19 the dalvik-cache."</p> <p>20 Do you see that?</p> <p>21 A. Yes.</p> <p>22 Q. What is in the dalvik-cache?</p> <p>23 MS. AGRAWAL: Objection. Form.</p> <p>24 A. The dalvik-cache contains an optimized</p> <p>25 version of the dex file, and if you run --</p> <p style="text-align: right;">Page 101</p>  |

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